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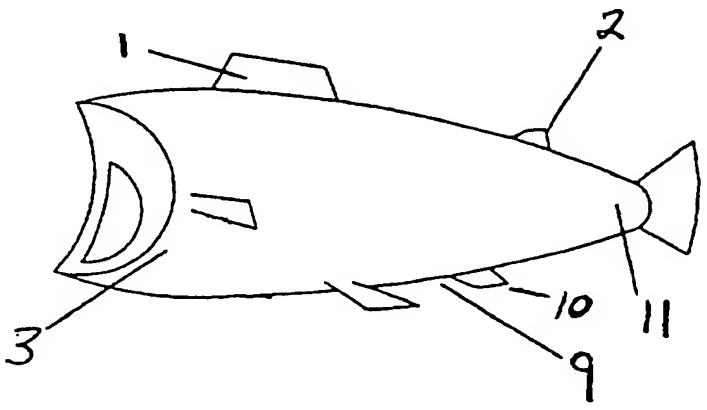
(54) Title: APPARATUS AND METHOD FOR TRIMMING OF FISH FILLETS



(57) Abstract: The automatic fillet-trimming machine comprises a first conveyor belt that is capable of registering the weight of the individual fillets, one or more computer-controlled cameras or other imaging means that identifies and localizes the undesired portions of a fish fillet to be removed, a height-measuring apparatus the registers the thickness of the fillets, a second conveyor belt that comprises suction means for securely holding the fillets, and which transports the fillets to a plurality of computer-controlled cutting devices, the movement of which is directed according to coordinates received from the imaging means, and means for weighing and removing waste products.

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Again, this technique is intended primarily to remove the surface layer from the skin-side of the fillet, and is incapable of flattening the fillet to the degree necessary for the effective removal of fatty tissues from the meat-side.

It is known to use devices comprising brushes to remove fat from the meat-side of a fillet, however machines of this type produce a rough and unattractive surface.

Summary of the invention

The present invention provides for an apparatus and method that overcome the above-described problem of removing fatty tissues from the meat-side of a fish fillet, as well as providing for the completely automated trimming of fish fillets.

The automatic apparatus and method according to the invention comprises an operator interface, an order-handling system and the automatic fillet-trimming machine. The operator interface comprises an operator panel mounted on or near the trimming apparatus. The operator panel provides means whereby the operator can calibrate the apparatus, input and/or reset the various parameters of the system.

The order-handling system is a computer-controlled system in communication with the trimming apparatus whereby specific instructions from a customer can be registered and performed, such as the total weight or number of fillets to be trimmed, specific instructions regarding the type of trimming to be performed, etc.

The automatic fillet-trimming machine comprises a first conveyor belt that is capable of registering the weight of the individual fillets, one or more computer-controlled cameras or other imaging means that identifies and localizes the undesired portions of a fish fillet to be removed, a height-measuring apparatus the registers the thickness of the fillets, a second conveyor belt that comprises suction means for securely holding the fillets, and which transports the fillets to a plurality of computer-controlled cutting devices, the movement of which is directed according to coordinates received from the imaging means, and means for weighing and removing waste products.

Figure 8 is a perspective view of a fillet showing the location of the vertical cut A along the dorsal edge.

Figure 9 is a perspective view of a fillet showing the location of the vertical cut C along the ventral edge.

Figure 10 is an overhead view of a fillet showing the regions of fat along the dorsal and ventral edges.

Figure 11 is a perspective view of the apparatus according to the invention.

Figure 12 is a perspective view of a cutting mechanism for performing vertical cuts along the dorsal edge..

Figure 13 is a perspective view of a cutting mechanism for performing the tail cut.

Figure 14 is a perspective view of a cutting mechanism for performing vertical cuts along the ventral edge.

Figure 15 is a perspective view of a cutting mechanism and lifting means for performing a horizontal cut along the dorsal edge of a fillet.

Figure 16 is a perspective view of a cutting mechanism and lifting means for performing a horizontal cut along the ventral edge of a fillet.

Detailed Description

The automatic fillet-trimming machine according to the invention comprises two trimming lines, one for the right-hand and one for the left-hand fillets. Fig. 11 shows a machine for a right hand fillet. As shown in figure 11, each line of the automatic trimming machine according to the invention comprises two conveyors 20 and 22 for transport of fish fillet. A weighing means 26, which is located under conveyor 20, registers the weight of the fillet. After being weighed, the fillet is transported under a camera 28 or other appropriate imaging means. Camera 28 generates an image of the fillet and image-analysis software identifies the undesired tissue to be removed, and the camera computer program calculates the five individual cuts to be performed. The five cutting coordinates are then sent to a control unit 32, which controls a plurality of cutting mechanisms. An operator interface panel may be used to manually input or adjust the

Cut D: Dorsal surface cut: A fourth cutting mechanism 44 having an oscillating blade 46 and a lifting plate 48 as shown in Fig. 15 removes the dorsal region surface-layer fat.

Cut E: Ventral surface cut: A fifth cutting mechanism 50 having an oscillating blade 52 and a lifting means 54 as shown in Fig. 16 removes the ventral region surface-layer fat.

Mode of operation

The machine operator selects the desired cuts to be performed from the machines database via an operator interface panel and filets are transported in to the machine.

The fillets are thereafter transported under the image camera 28 by conveyor 20, where the areas of undesired tissue are identified, the coordinates of these areas are registered and the necessary movement of the cutting mechanisms calculated.

After the camera computer has calculated the cuts to be performed, the fillet is transported by second conveyor 22 to a first cutting mechanism 38. Conveyor 22 is perforated, and a vacuum system applies suction to the fillets, holding them securely to the surface of the conveyor.

The horizontal position of cutting mechanism 38 is directed by control unit 32 according to the coordinates obtained from camera 28 and the speed of conveyor 22. As shown in Fig 11, cutting mechanism 38 is positioned at an angle relative to the direction of conveyor 22. Cutting mechanism 38 cuts along the fillet's dorsal edge based upon the signal sent from the computer in camera 28 to control unit 32.

Cutting mechanism 38, as shown in Fig 12, comprises a footplate 62 that raises the fillet into contact with circular blade 40. Circular blade 40 is driven by a motor 64, and is continuously sharpened by a sharpener 66 and cleaned by water jets integrated into a faceplate 68. The angle of cutting mechanism 38 causes the resulting waste product to lay on the footplate until the cutting mechanism returns to its 0 position, where the waste is then suctioned off by a vacuum apparatus (not shown) and into a hopper 82. The weight of the waste is calculated and stored in a database by a computer 30. Any waste tissue that

After the dorsal region surface-layer fat has been removed, the fillet is transported to fifth cutting mechanism 50, as shown in Fig 16. Cutting mechanism 50 comprises a horizontally oscillating blade 52 driven by a motor 87. Cutting mechanism 50 performs a horizontal cut that removes the ventral region surface-layer fat. As is the case with the dorsal region, the ventral edge must be raised in order to present a flat surface for cutting. The ventral edge of the fillet is of a slightly different shape than the dorsal edge. Cutting mechanism 50 therefore comprises a lifting plate 54 and a horizontal guide member 88. The ventral edge of the fillet rides up on plate 54, and is caused to press upon guide member 88, thus presenting a horizontal surface for cutting to blade 52. Cutting mechanism 50 also comprises a vacuum nozzle 90, integrated water jets 92 and a sharpening unit 94 that perform similar functions as in cutting mechanism 44.

The finished fillet product is then transported to the end of the trimming machine and collected for packaging, etc.

aligned circular blade (40) driven by a motor (64), said first cutting mechanism (38) having its horizontal position relative to the direction of conveyor (22) directed by signals sent from control unit (32) in such a manner as to follow the dorsal edge of the fillet such that undesired tissues are removed,

b. a second cutting mechanism (34) located downstream of camera (28) and upstream of cutting mechanism (38), said second cutting mechanism (34) comprising a knife blade (36) arranged to remove the tail section of the fillet in a chopping motion, said cutting mechanism (34) being directed by control unit (32) to perform the cut at the appropriate time as determined by the length of the fillet as recorded by camera (28),

c. a third cutting mechanism (42) located downstream from, and on the opposite side of conveyor (22) as, cutting mechanism (38), said third cutting mechanism (42) being substantially identical to first cutting mechanism (38), and being directed by control unit (32) to perform a vertical cut along the ventral edge of the fillet according to coordinates as recorded by camera (28),

d. a fourth cutting mechanism (44) located downstream from cutting mechanism (42) and on the same side of conveyor (22) as cutting mechanism (38), said fourth cutting mechanism comprising a horizontally oscillating blade (46) driven by a motor (74), said fourth cutting mechanism being directed by control unit (32) to perform a horizontal cut on the dorsal, meat-side surface of the fillet according to the coordinates of the undesired tissue on the dorsal surface as identified by camera (28) and the vertical thickness of the fillet as determined by the height-measuring device (24), said fourth cutting mechanism (44) further comprising a curved lifting plate (48) that is directed by control unit (32) to press into the fillet and raise the fillets dorsal edge to substantially the same height as the maximum thickness of the fillet as determined by height-measuring device (24), thereby causing the fillet to assume a substantially planar profile to oscillating blade (46), and

7. The apparatus according to claim 6, whereby conveyor (22) is perforated and connected to a vacuum system for applying suction to the fillet to hold it securely to its surface.

8. The apparatus according to claim 7, further comprising means for the removal, collection and recording the weight of the undesired tissues that are removed.

9. The apparatus according to claim 8, whereby the waste-removal and recording means comprise

a. a compressed air jet located in the vicinity of cutting mechanism (34) that blows the tail section into a container (39), said container being connected by a vacuum system that draws the tail section into to a hopper (82),
b. software in computer (30) that calculates the weight of the tail section based upon the dimensions recorded by camera (28),
c. a suction device located near the vicinity of cutting mechanism (38), whereby waste products, which are drawn by cutting device (38) towards the edge of conveyor (22) when cutting device (38) returns to its default position, are suctioned away to hopper (82),
d. software in computer (30) that calculates the weight of the dorsal-edge waste based on the dimensions obtained from camera (28),
e. a container located in the vicinity of cutting device (42) into which the ventral-edge waste products fall when cutting device (42) returns to its default position, said container comprising a scale (58) that weighs the waste products, sends this information to computer (30), and further comprising means for ejecting the waste products onto a waste-collection conveyor (60),
f. vacuum means connected to nozzles (81) and (90) of cutting mechanisms (44) and (50), said vacuum means being designed to suction away waste products from the surface of the fillets into hopper (82),
g. software in computer (30) that calculates the weight of the surface waste based on the dimensions obtained from camera (28), and

having image analysis software capable of identifying and mapping the coordinates of undesired tissues from a fish fillet and communicating said coordinates to a control unit (32), a height measuring device located upstream of the cutting mechanism capable of recording the thickness of the fillet along its length and communicating this information to control unit (32), said control unit being capable of directing the height of oscillating blade (46) so as to follow the surface of the fillet, removing a predetermined thickness of tissues from the surface.

15. A method for removing undesired tissues from the meat-side surface of a fish fillet, comprising the steps of conveying a fillet under a cutting mechanism (44) having a horizontally oscillating blade, raising the edge of the fillet so that the fillet assumes a substantially planar profile whereby fatty tissues and the like that ordinarily are lower than the thicker, meat-portion of the fillet are raised into substantially the same height as the meat-portion, and thereafter slicing away the undesired tissues.

16. The method according to claim 15, whereby the edge of the fillet is raised by a curved lifting plate (48) that is caused to be pressed into the fillet, causing the edge to ride up the curved surface of the plate, thus causing the fillet to present a substantially planar profile to the horizontal blade.

17. The method according to claim 16, whereby a horizontal guide member (78) presses down on the fillet in order to assist in causing the fillet to assume a planar profile.

18. The method according to claim 17 whereby suction is applied to the surface tissues of the fillet at the moment of cutting.

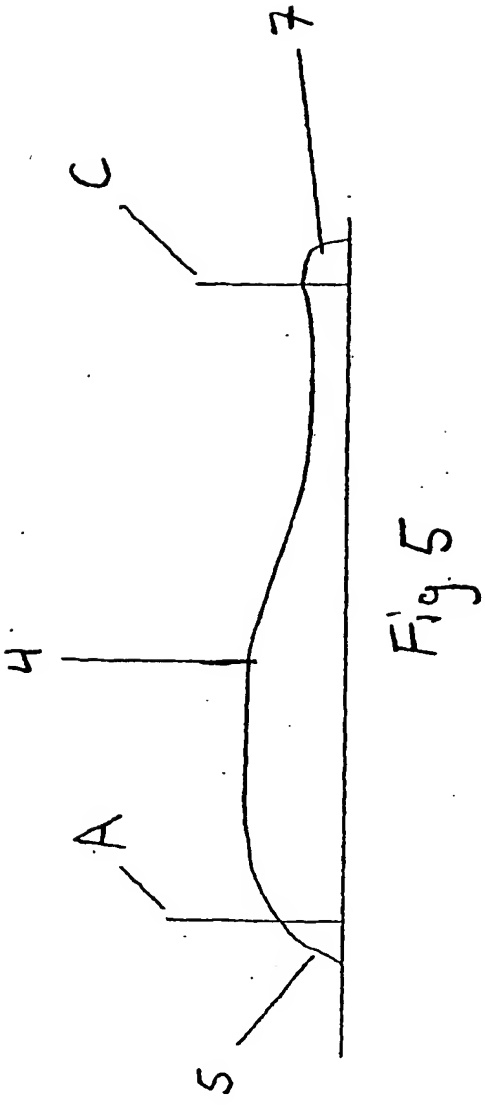

Fig 5

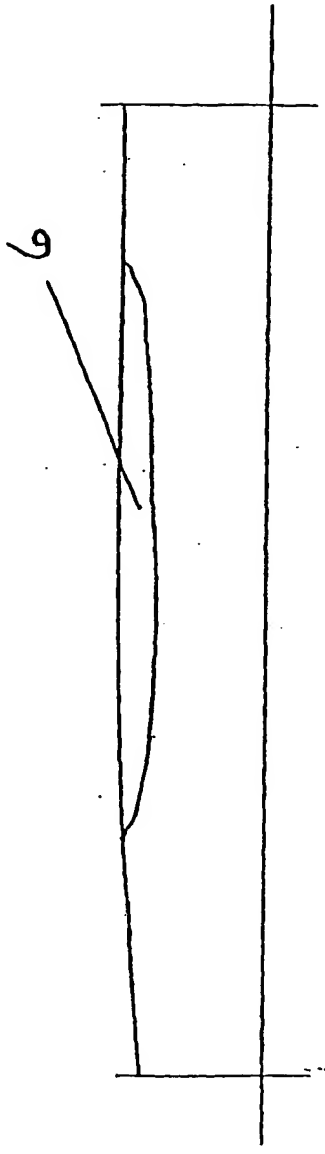

Fig 6

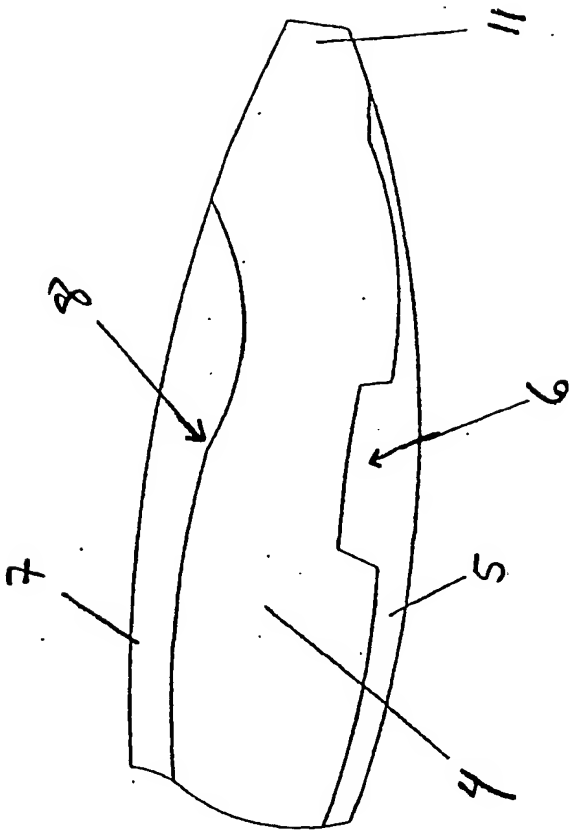

Fig 10

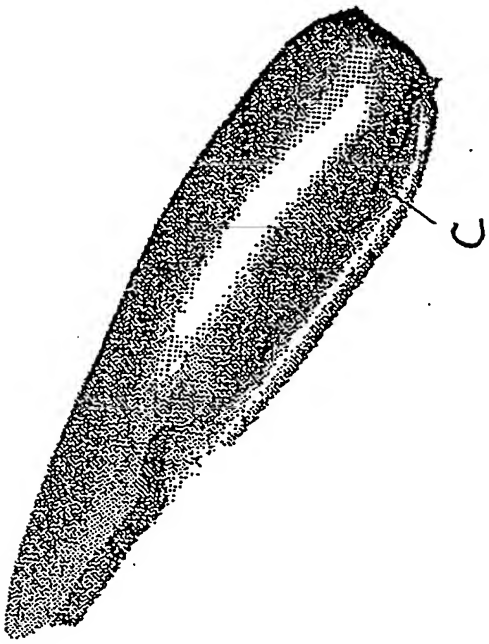

Fig 9

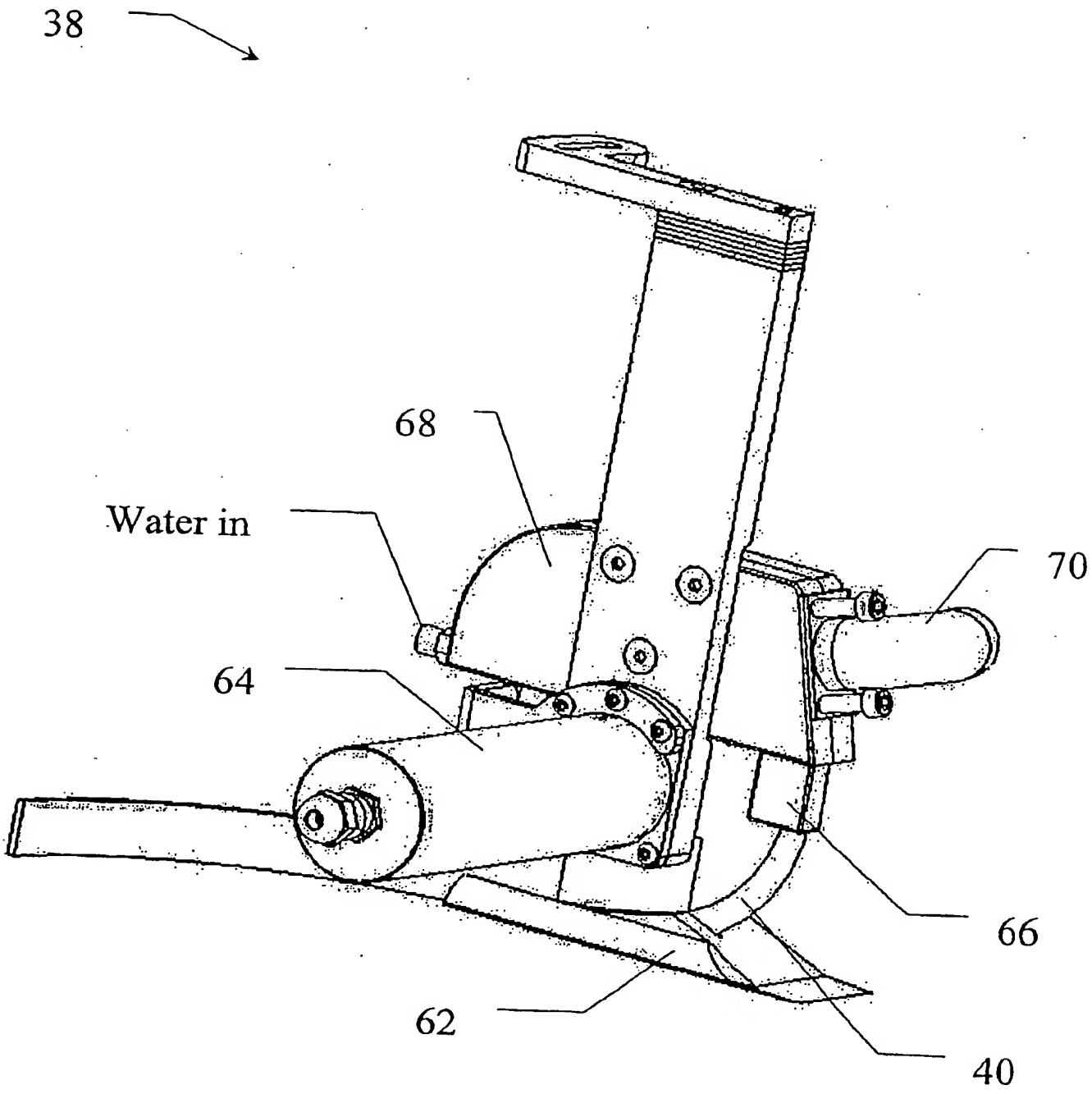

Fig. 12

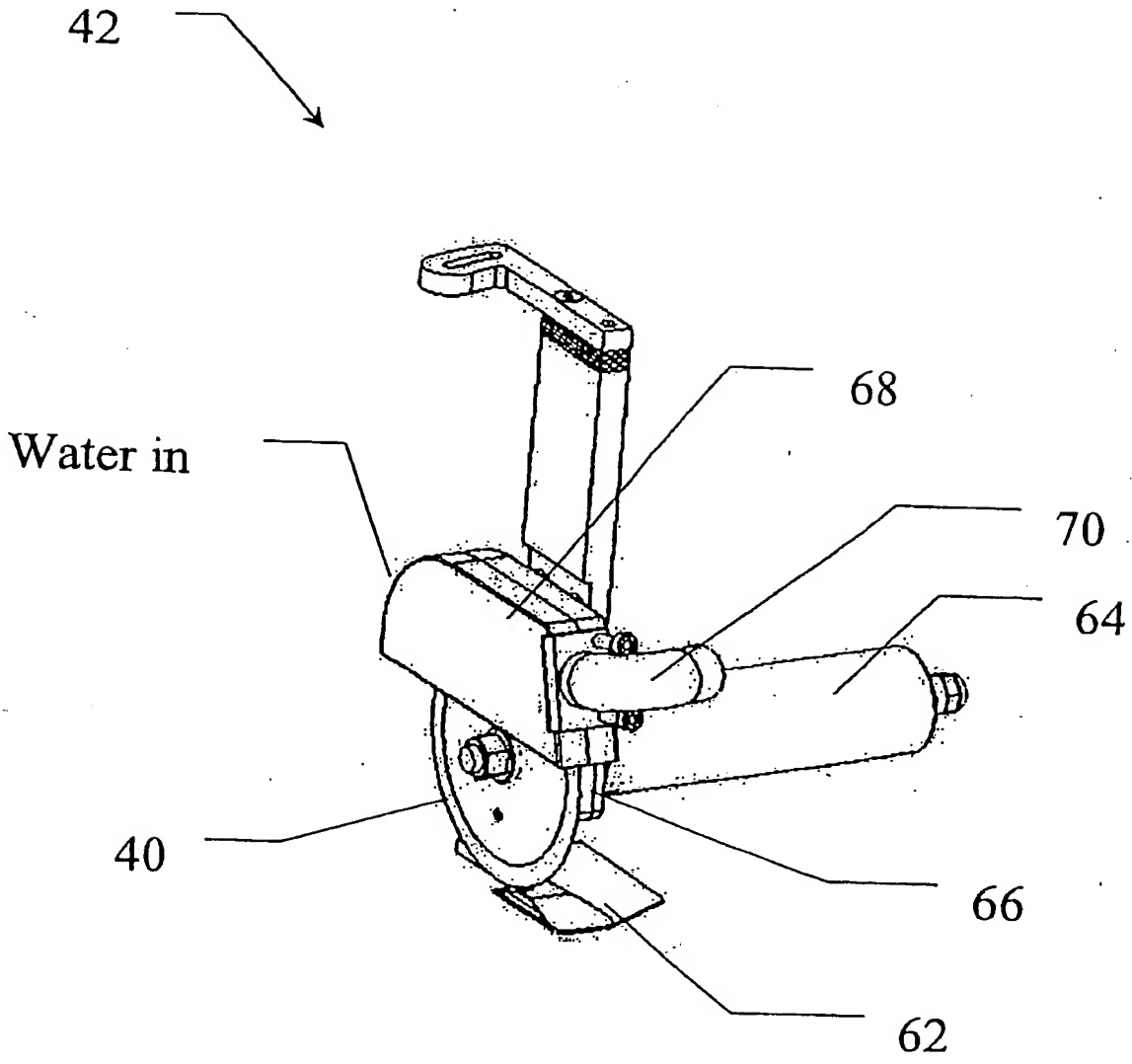

Fig. 14

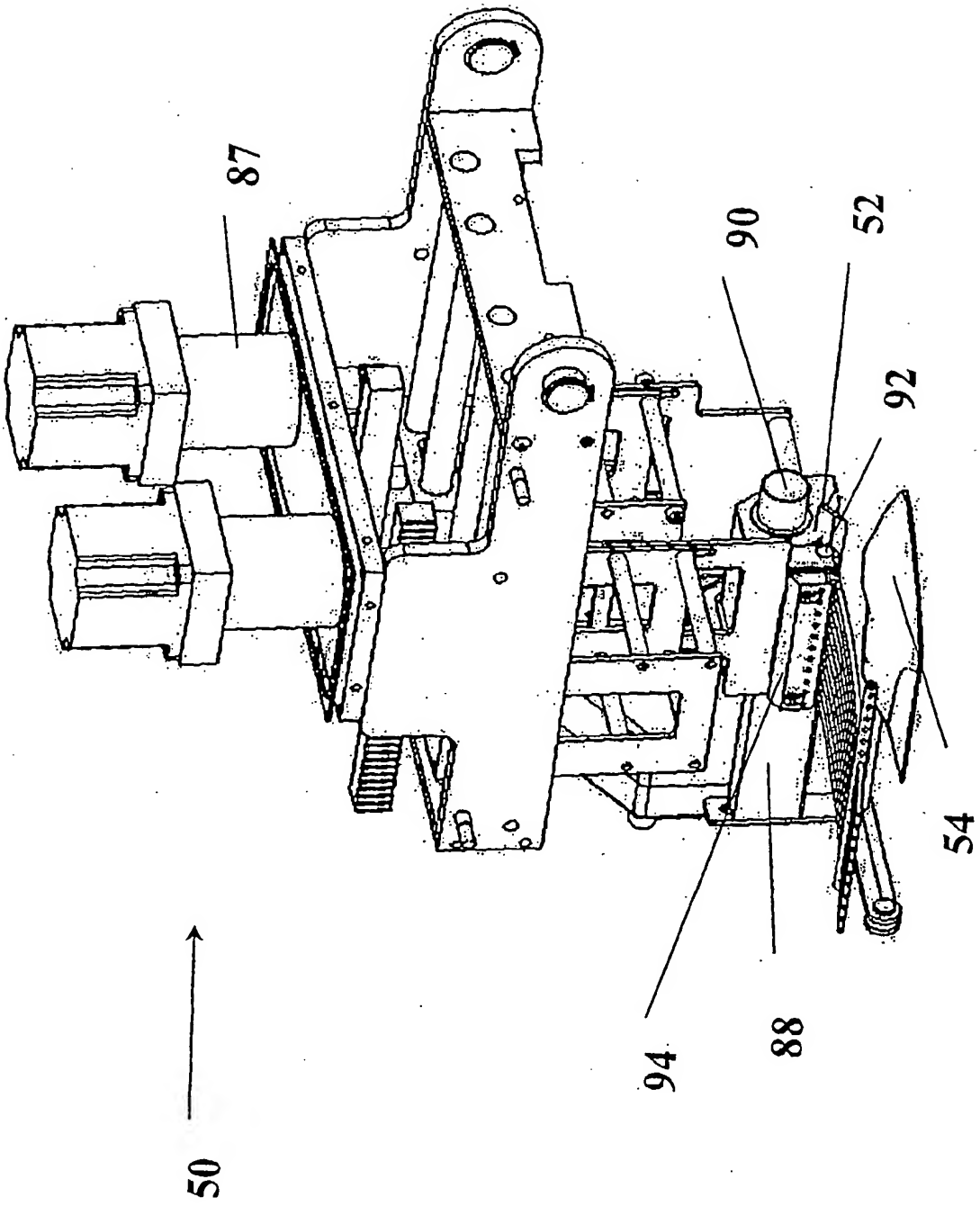

Fig 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 02/00402

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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